

## EDUCATING ENGINEERS: CONTRIBUTION OF MUSLIM WOMEN EDUCATORS IN UNIVERSITI TEKNOLOGI MALAYSIA

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### ABSTRACT

*History has written that women play an important role in developing the UMMAH. From the birth of Hawa as a companion to Prophet Adam a.s, the great impact of women's role in the society is clearly portrayed in the famous proverb "the hand that rock the cradle, rock the world". Therefore, underlying the phrase, rhythms and motions are reflected by the characteristics of the women. In Islam, Muslim women are regarded as a class of their own. They are highly respected as our companions, guiders and mothers in a family institution. However in modern society, their womanhood roles have increased. They are highly educated and become a part of the nation building together with the man. They can be involved in many different fields from teaching, nursing, managerial to professional engineers. In Malaysia, Muslim women fill many universities as educators. They themselves are professionals and involve in educating technocrats and professionals. Universiti Teknologi Malaysia is one of the engineering universities in Malaysia with the main aims to educating engineers. This university has a blend of engineering educators from both genders. Although engineering is the field dominated by man, the current trend shows significant increase in women engineering educators as well as the graduates. 30% of the engineering educators in UTM are represented by Muslim women. 13% of these women are recognized for their contributions and achievement and was awarded with professorship. 2% of Muslim women educators in UTM are the university executive members which involve in university decision making.*

### Introduction

The purpose of this research is to find answer to some basic questions regarding the human mental processes especially women that occur in dealing with knowledge in aspect of educating engineers, and the manner in which this knowledge is organized for innovation and problem solving. In reading the Qur'an and literature on Hadith of the

Prophet, the basic sources of information on Islam, one finds a great deal of emphasis on knowledge and the special position given to those with knowledge. One, therefore, wonders as to why the Muslims, professing Islam, do not appear to be the leaders in knowledge. In this case however it is not only necessary to understand why that may be the case but also to search for ways to correct this situation.

Research in human problem solving has resulted in paradigms about the working of the human mind. Advances in computers and the use of computers in problem solving, in particular the use of the techniques based on artificial intelligence, are having further impact on these paradigms. It is to be noted that while these paradigms may give a rational explanation to what we perceive through our senses, they do not necessarily represent the ultimate reality of the human mind.

Knowledge comes from learning about things, and it requires mental apprehension or cognition. The process of learning consists of using existing knowledge, gaining new knowledge, organizing, and storing the new and old knowledge. Stored knowledge is recalled and used in responding to the events in the environment. Our present understanding of how the human mind organizes knowledge points to the following two characteristics; what the mind stores is refined from of received information, and it also retains the context of this information.

The main topic of the Qur'an is also the human mind. In particular, it deals with the question of how the humans do use or should use their mind in responding to the events in the environment. Based on our current understanding, it appears that the style of Qur'anic descriptions is well suited to human cognitive skills, e.g. details are relevant to a context, reasoning is goal oriented, the same subject is presented using several alternate perspectives, the message is conveyed through patterns of things or parables called *amthal al-Qur'an*, and positives as well as contrary to positive templates of behavior, *mujibat al-falah* and *mujibat al-khusran*, are presented.

Some examples of the concepts and terms that the Qur'an uses about knowledge are; being aware of or having cognizance of (*dirayah*), insight, literary and spiritual, reasoning and rationalizing with facts and rules (Qur'an 29:49), contrary to guesswork or conjecture (Qur'an 7:7), and learning and discovering truth (Qur'an 22:54).

Knowledge engineering deals with building systems based on the knowledge of someone who is well experienced in dealing with the events of some domain of application. Events generate stimuli and require responses. One must properly recognize the event, and then generate an appropriate response; this process is called problem solving. In solving a problem, one must have access to what may be previously known, retrieve relevant data and rules, and apply this knowledge effectively. This may be described as a goal seeking process. Given some premise and some desired goal, one may use the knowledge to move forward from the premise toward the desired goal until that goal is reached. Alternatively, one may use the knowledge to move backward from the goal to the premise in order to establish that the goal can be reached from the premise. In either case, one goes through several intermediate steps, and collectively these steps

constitute a chain of thought. Reasoning from the premise to the goal is called forward chaining, and reasoning from goal to the premise is called backward chaining; the choice generally depends on the situation.

Many people do not possess the knowledge that may be required to solve problems in a given area, or they are unable to use effectively the knowledge that they have. Those who do, are known as experts. It takes a human being many years, possibly decades, to become an expert in some area. Direct use of an expert's knowledge is limited by the possibilities of personal contacts. However, if one can acquire successfully the knowledge of how an expert solves problems then it can be put to widespread use. Furthermore, if one can successfully transfer the expert's knowledge to a machine, then the access and use of this knowledge can be increased manifold. Moreover, one is now able to exploit the inherent capabilities of the machines to store vast amounts of information, recall it when needed, and put it to use at lightning speed.

A mechanism for storing and organizing facts and rules from known situations, and using them for resolution of new situations is called a knowledge engine. Designed properly, a knowledge engine can unleash the problem solving power contained in knowledge. Traditionally, the human mind has served as the knowledge engine. It is fueled by the stimuli from the environment, uses existing knowledge to process information, solves problems, acquires new knowledge in the process, organizes and updates existing knowledge, and generates information leading to the creation of new knowledge.

### **Educating Engineers Concepts**

The basic material of knowledge educating engineers is information, in raw and refined form. This information consists of description of objects types covering their explicit and implicit attributes and instances. Alternatively, we may say that an object type is described by some relevant attribute names, whereas a specific instance of an object to refer to object name, attributes to refer to attribute names, and values to refer to instances.

Consider the first lesson in knowledge educating engineer given to Prophet Adam a.s by Allah, and described in the Qur'an: "And taught Adam the names of things." (Qur'an 2: 31-33). It appears that in this lesson a process of synthesis of knowledge was in the making; patterns were in motion, and recognition was in action. This was the first phenomena that involved the human mind in abstracting the attributes and assigning name to things based on those perceived attributes. The Qur'an describes knowledge and the principles and tools of knowledge educating engineer as:

- a) *'Ilm al-Yaqin* (Qur'an 102: 5), certainty or knowledge gained from reasoning and inference.
- b) *'Ayn al-Yaqin* (Qur'an 102: 7), certainty or knowledge gained from sight (from the senses), and

- c) *Haqq al-Yaqin* (Qur'an 69: 51), certainty or knowledge that is absolute in truth, not subject to alternation from knowledge received through sense perceptions, reasoning, or inference.

The first two items are related to the knowledge that is acquired, and the third item points to the knowledge revealed to mankind through the ages.

### **Women Engineering Educators Achievement**

In the past, engineering educators are the profession dominated by male society. Furthermore, the nature of the disciplines and the perception of the society towards working women and knowledgeable women make this profession unpopular among women. Today, the history is gradually changing. Women engineering educators are accepted and rewarded for their contributions.

In the Year 2003, Jennifer S. Curtis, professor of chemical engineering, head of the Department of Freshman Engineering and associate engineering dean for undergraduate education, received the Sharon Keillor Award for Women in Engineering Education during a June 25 ceremony at the American Society of Engineering Education Annual Conference and Exhibition. The award recognizes women engineering educators who have outstanding records of teaching, research and service. Similar award was received by Emily L. Allen of the engineering faculty at San José State University in year 2000. She was selected from 40 women engineers out of 200 applicants from throughout the United State to attend a national leadership conference sponsored by the National Science Foundation (NSF). The conference was designed to familiarize high-achieving, mid-career women engineering educators with academic leadership roles ranging from department chair to university president.

Obviously none of them are Muslim engineering educators. In Islam, role of women has been well documented and are highly respected. Although there is no document available to clearly state their achievement in engineering education, their role as educators is clearly written.

### **The History of Muslim Women in Society**

It has been shown throughout the history of Islam that women took part in the First and Second Ba'yat al-Aqabah (pledges of allegiance). Furthermore, it was Khadija, the wife of the Prophet Mohamed (SAAS) who was the first to believe in, support and comfort our Prophet. It was Somayya who was among the first to be martyred upholding Islam. Al-Bukhari and Ahmed (reporters of the traditions of the Prophet Mohamed) cited Al-Rabiyya' the daughter of Mu'awadh as saying: 'We used to participate in the battles with the Prophet of Allah. We gave water to the fighters, served them, and returned the dead and wounded to Medina.' Also Muslim, Ibn Majah and Ahmed (in their narrations) said that Umm Ateyya, the Ansari, said: 'I accompanied the Messenger of Allah (SAAS)

seven times, guarding the camp, making the food, treating the wounded and caring for the sick'.

In his Sahih, Muslim reported Umm Sulaim, the wife of Abi Talha, as saying that she carried a dagger on the day of the battle, of Hunain. When the Prophet (SAAS) asked her about it she said, 'I carry it so that I can defend myself against the enemies.' The Messenger (SAAS) did not forbid this. Nusaibah, the daughter of Ka'b, fought in the wars of riddah (apostasy) at the time of the caliphate of Abu Bakr and she suffered many wounds caused by stabs and strikes.

### **Muslim Women Financial Freedom**

The woman has full financial status that is no less than that of the man. She has the right, in the same way that a man does, to possess all types of wealth whether it be in the form of assets, real estate or cash. She has the right to use her wealth in any manner she wishes to as long as it is approved by the Shari'a. So she can buy, sell, trade, barter, provide grants and loans, incur loans, exchange assets etc. All these actions do not require the consent of any male whether this be her father, husband, or brother. In his sahih, Al-Bukhari titles one chapter: "A woman is permitted to free slaves and give gifts to someone other than her husband, unless she is mentally deranged." In this he reported that Umm al-Muminin, the wife of the Messenger of Allah (SAAS), Maimunah bint Al-Harith freed a girl born as her slave without asking for the Prophet's (SAAS) permission. When she mentioned this to him he said: 'If you had given her to your maternal uncle as a gift, your reward (with Allah) would have been greater.'

### **Muslim Women in Engineering Education in Malaysia**

Women make up half of society and they are responsible for the nurturing, guidance and reformation of the subsequent generations of men and women. It is the female who imbues principles and faith into the souls of the nation. The woman's nature as the mother means that there are certain virtues, which Allah has made specific to her such as the protection of her honour and the honour of her offspring. The caring nature and ability to acquire knowledge enable them to become good educators.

The development in science and technology and the equal opportunity with men in seeking educations produces many women educators especially in science and engineering. Today, all the universities in Malaysia employed Women Educators as their academic members.

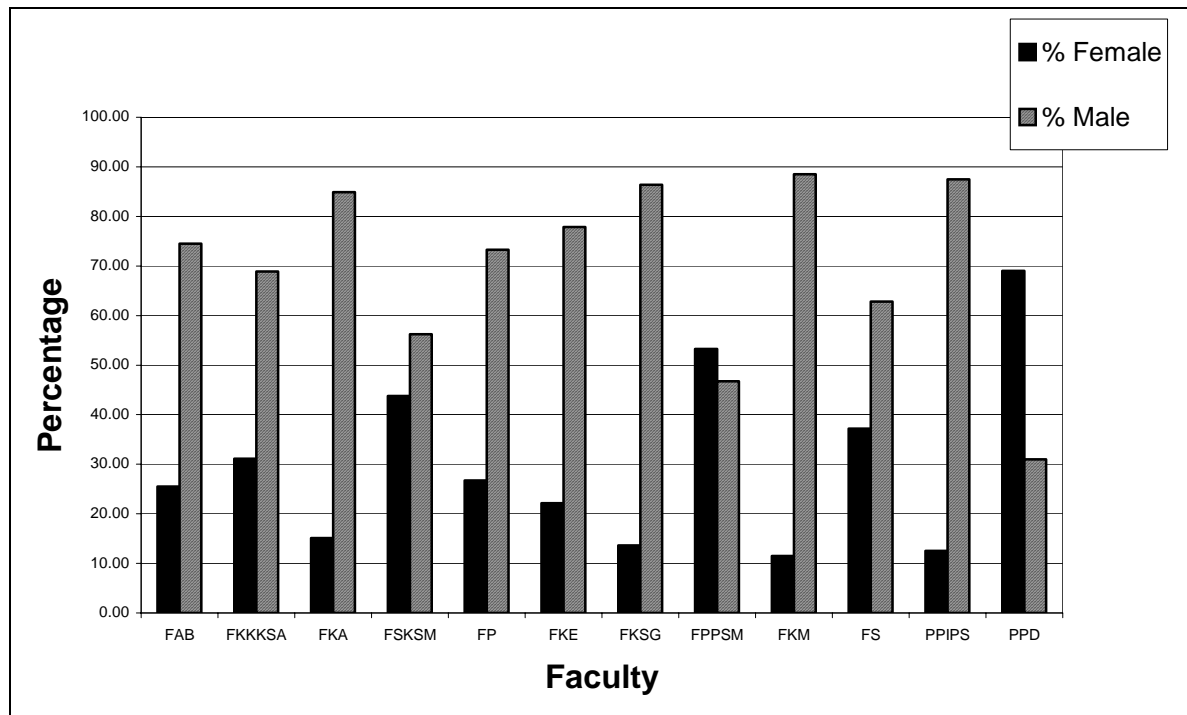
In this paper, the significance of Muslim women engineering educator's contribution in modern Malaysian society is assessed. The Universiti Teknologi Malaysia was used as the case study as it is the leading engineering university in Malaysia. The study conducted and the findings are discussed in the following sections.

## Results and Discussion

### Contribution of Muslim Women Engineering Educators in UTM

Universiti Teknologi Malaysia (UTM) is the renowned engineering university in Malaysia. Founded 100 years ago and has respectable reputations in producing engineering professionals and technocrats for Malaysia and the South East Asia region. UTM has five core-engineering faculties, six engineering education support faculties, center for Diploma Studies, center for Continuing Education Program and many institutes and centers of excellence. Indeed, Muslim Women educators involve in all the listed units but the percentage or their distributions are varies.

Based on the data provided by UTM, the ratio of woman to man educators in UTM is 1:3. The ratio indicates the 30% contributions of Muslim women in educating engineers in UTM. The number seems to be small but the value of their contributions cannot be denied and will be discussed in this paper. Figure 1 summarizes the engagement of UTM in many different engineering disciplines in Malaysia and the percentage distribution of academic members in different faculties and in the center of diploma programs in UTM-KL campus.



**Figure 1:** Distribution of Muslim Women Educators in All Faculties in UTM

The above figure shows that the core engineering faculties (FKKS, FKA, FKE, FKSG, FKM) in UTM are male dominated. It is significant to mention that the faculties and the center that involve as a supporting unit to the engineering education such as FPPS, FSKS and PPD have more than 40% Muslim women educators

compared to the other faculties listed. It is interesting to see that PPD has a highest number of Muslim women educators with the percentage of nearly 70%. The majority of these Muslim women educators are from Diploma studies related to engineering such as Education Administration and Services Course, Sciences Course, Electrical Engineering Course and Preparation Centre for Japanese Technical Course (refer Table 1). Why UTM-KL has higher Muslim women educators? Based on the UTM campus transfer history, it can be suggested that this phenomena was also partly caused by the UTM relocation program where many women educators were opted to remain in UTM-KL instead of being relocated to main UTM campus in Skudai, Johor. Reasons could be of personal matters and other administrative commitments.

<b>Department</b>	<b>Number of Woman Educators</b>	<b>Number of Man Educators</b>	<b>Percentage</b>
Civil Engineering Course	8	9	47%
<b>Electrical Engineering Course</b>	<b>28</b>	<b>25</b>	<b>65%</b>
Mechanical Engineering Course	7	16	30%
<b>Administration and Services Course</b>	<b>40</b>	<b>17</b>	<b>70%</b>
<b>Sciences Course</b>	<b>37</b>	<b>13</b>	<b>74%</b>
<b>Preparation Centre for Japanese Technical Course</b>	<b>6</b>	<b>2</b>	<b>75%</b>
ATMA	3	7	33.3%

**Table 1:** Distribution of Muslim Women Educators in Center of Diploma Studies (UTM-KL)

Indeed the Figure 1 indicates the male domination in the core engineering education in UTM. Some departments in the core engineering faculties have no women engineering educators at all. Table 2 shows the number of departments in core engineering faculties with no women engineering educators. Those departments are Marine Engineering Department (FKM), Remote Sensing Department (GKSG), Geomatic Department (FKGS) and MICE (FKE). The nature of the discipline may be one of the factors of not having the female as their academic members. There was minimal new academic staff recruitment activity shown by these departments since 2003. Most probably their engineering educator to students' ratio has been achieved and no further intake is necessary.

Department	Number of Engineering Educators			
	Lecturers		Tutors	
	Woman	Man	Woman	Man
Marine Engineering Department (FKM)	0	11	0	0
1.Remote Sensing Department	0	9	0	1
2. Geomatics Department (FKGS)	0	24	0	0
MICE (FKE)	0	18	0	1

**Table 2:** The Muslim Man Engineering Educators Dominating Departments in UTM.

Although the listed departments in Table 2 are without any woman as their engineering educators, other departments in the university have taken positive measure towards the recruitment of woman as educators for the past 5 years. The percentage of Muslim women intake as tutors is 15.8% while the percentage of Muslim man intake as tutor is only 8.1% as shown in Table 3. Two factors for the changes could be attributed by the increase in number of women engineers who are qualified and equally outstanding in their academic achievement, which qualifies them to become engineering educators/academicians in higher learning institutions. Another factor could be due to the increment in female students (data not shown) in the engineering disciplines, which require women engineering educators to relate themselves better. Furthermore women in general are good educators besides having a special women's touch and motivations.

Number of Woman Engineering Educators			Number of Man Engineering Educators		
Lecturer	Tutor	%	Lecturer	Tutor	%
506	80	15.8	981	80	8.1

**Table 3:** Percentage of Tutors Recruitment in UTM in year 2003

### **Employment Distribution of Muslim Women Educators in UTM**

As the number of Muslim women engineering educators increased in all faculties, they are also actively involve in career development. Many of these educators are awarded for their contributions and achievement in providing engineering educations to the young Malaysian nations. Various positions are offered to the Muslim women educators in UTM. The general employment of educators/academic staffs to UTM is using a First Degree in related field and will be offered temporary employment as tutor. New tutors and master degree holder will be directed to further their study up to doctorate level. Those with Master and PhD degree will be offered permanent position as Lecturer.



The following Figure 2 shows the distributions of employment among Muslim women educators in UTM. 80% of the total Muslim women educators are lecturer, 15% are tutors and the rest are Assistant Lecturers and Teachers. The figure shows the capability of Muslim women in educating the future engineers and professionals.

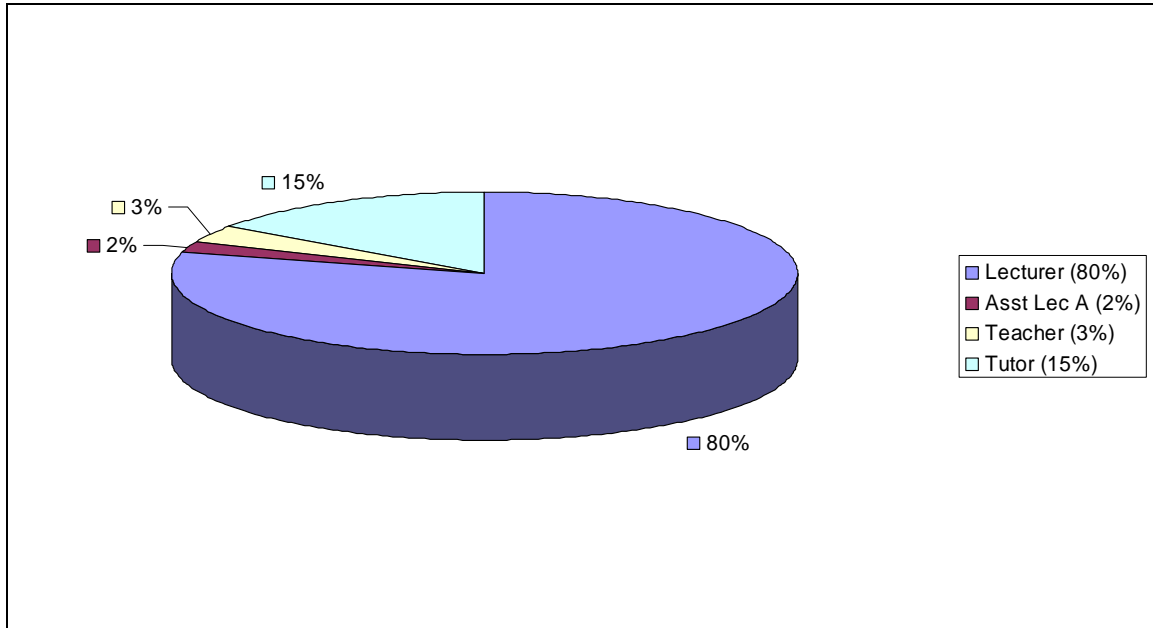


Figure 2: The Employment Distribution of Muslim Women Educators in UTM.

### **The Achievement of Muslim Women Educators in UTM**

There were 506 Muslim women educators in UTM based on data ended 31<sup>st</sup> March 2003. They have an equal opportunity to pursue their career. 17.43% of them are PhD doctorates from various disciplines. They have similar opportunity for higher career development and achievement by being awarded with professorship, associate professor or senior lecturer (new awarded post effective by year 2004 under SSM scheme). All educators (employees) of UTM have their right for career promotions and are encourage to applying for higher position/rank in UTM administration. Figure 3 shows the percentage of their academic and career achievement while in UTM. Data also shown that two of the Muslim women engineering educators are qualified professional engineers with carry the Ir title. Although the number is insignificant, but their ability to qualify such title is highly regarded and respected. It is hope that the statistic will improve in the years to come. Such qualification will qualify them to gain financial freedom as the are allowed to practice as an engineering consultant in any engineering firms.

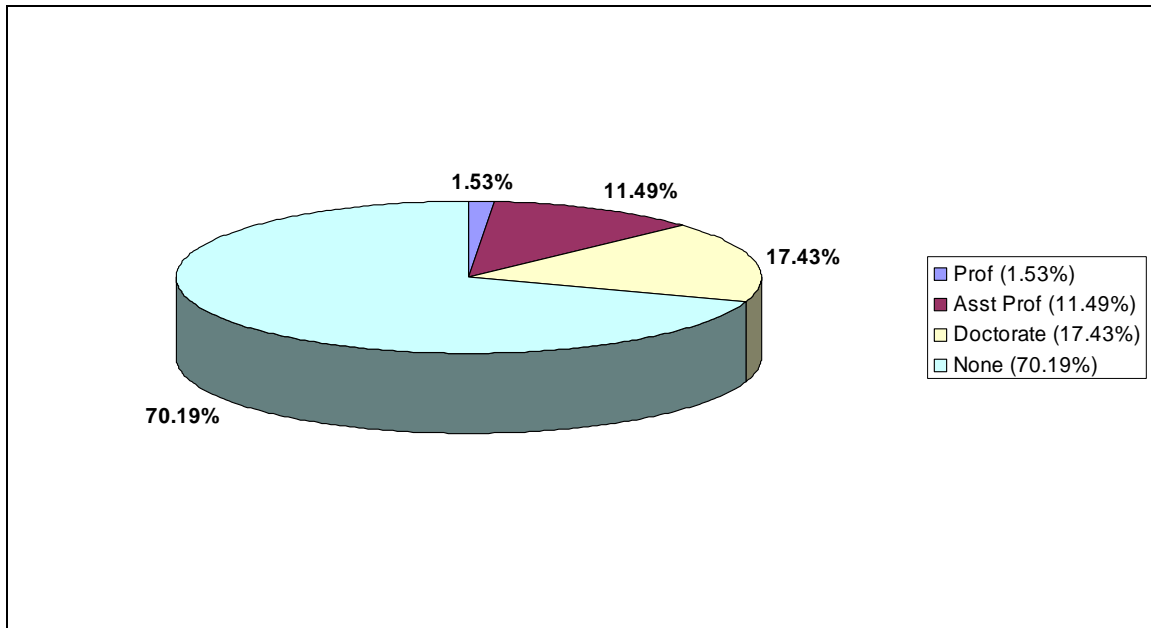


Figure 3: The Percentage of Muslim Women Engineering Educators Academic and Career Achievement in UTM.

### Muslim Women Engineering Educators in UTM Administration Office

UTM administrative acknowledges the capability of their staffs. Muslim women educators are given similar opportunity with their male counterpart in holding positions at the administrative level. In general, fellow lecturers with distinctive achievement and capabilities will be appointed to hold certain administrative positions in faculty level as well as at the university level. Many Muslim women educators in UTM have been given this privilege. Most of the administrative positions are offered only for certain period of time with the minimum period of two years. Records have shown significant number of these women who have served or are serving UTM at the administration level.

Currently, the administrative positions in UTM that have Muslim Women Educators are Senate Members, Deputy Dean (Academic & Administration/ Post-graduate & Research), Manager Information Technology (MIS), Head of Department, Director or Executive members in Centre of Excellence and Units and at departmental level they are appointed as Head of Laboratory. Other important posts to highlight are the Chancellor of UTM, Duli Yang Maha Mulia Baginda Sultanah Zanariah binti Almarhum Tunku Ahmad, Sultanah Johor. One of the two Pro-Chancellors is Yang Amat Mulia Raja Zarith Sofiah binti Almarhum Sultan Idris Shah DK., SPMJ, SPCM, M.A. (Oxon). Figure 7 shows administration positions hold by Muslim women educators of UTM. The UTM Chief Librarian is also a woman (Kamariah Nor Mohd Desa, B.L. Sc. (UiTM) M.A. Lib. & Info. Sc. (Loughborough, UK)). Although the Chancellor and its Pro-Chancellor are women, the percentage of Muslim Women involve in administrative level is only around 5%. Table 4 shows the number of Muslim Women Educators with administrative

position. Those who are in directorate positions are appointed as university Executive Member.

<b>Position</b>	<b>Number of Muslim Woman Educators</b>
The Chancellor	1
The Pro-Chancellor	1
University Executive Member	9
Dean	3
Deputy Dean	3
Director of Center of Excellence/Units	5
Head of Department	11
Executive Staff at Center of Excellence/Units	15

**Table 4:** The Administrative Positions Awarded to Muslim Women Educators in UTM

### **Contribution of Muslim Women Engineering Educators of UTM to the Society**

Small study was also conducted to get some data on Muslim women engineering educators in UTM in relation to their commitment to family institution and the society outside the academic environment. 10% of total Muslim women educators in UTM have responded to the questionnaire given. The majority of the respondents are of the age between 30 to 40 years. 96% of the respondents are married with average of two young children. This finding shows that besides having a secure position in university they are also contributing to the society by forming a family institution. The position as educators in the university does not restrict them from having a family life. Majority of the respondent are actively involved in non academic activities at their departmental level as well as in the society outside university.

In terms of tertiary level educational background, more then 70 percent have experienced studying abroad. This indicates that Muslim women are encouraged to gain knowledge for their professional skills outside Malaysia. This also indicates the competency and capabilities of these Muslim women educators in gaining world class recognition in their academic achievement.

There was no discrimination or bias in appointment of Muslim women educators based on their social background. Those who were brought up in rural and urban township area are equally accepted. Their appointment to the university is based on their academic performance. Different social background contributed to a unique blend of university academic society. This could offer certain values and encouragement among the students to excel regardless of their social background.

Educators are not only specialized on technical and engineering subjects or courses. Different life experiences among the educators could be shared during student counseling and motivation sessions. They participate in becoming student academic advisors, monitor students social activities in the faculty. Approximately 2.5% of the Muslim women educators in UTM volunteered as fellows at residential colleges under Student Affair. They are actively involved in student activities at student residential

colleges and assist the Student Affair in caring for students well being. The percentage is rather small but their commitment and willingness to contribute to the development of social skills among engineering students are very valuable.

## **Conclusion and Recommendation**

Engineer is a challenging profession. 30% of the engineering educators in UTM are represented by Muslim women. 13% of these women are recognized for their contributions and achievement and was awarded with professorship. Among 506 Muslim women educators, only two educators are the qualified professional engineers (Ir). 2% of Muslim women educators in UTM are the university executive members which involve in university executive meeting and decision making.

The study on the contribution of Muslim women engineering educators could be expanded to other universities in Malaysia and other Muslim countries.

It is meaningful to have Muslim Women Engineering Educators Society as a platform to discuss issues related to education and students development. This platform could be a venue for organizing their activities, highlighting their achievement and recognition towards modern Islamic society.

## **Materials and Methods**

The sources of information gathered in this study are based on:

1. UTM Websites (<http://www.utm.my>)
2. UTM Telephone Directory (data of year end 31<sup>st</sup> March 2003)
3. Random feedback from Muslim women educators of UTM questionnaires.

## **References**

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